

## Book Reviews

GENETICS AND ANALYSIS OF QUANTITATIVE TRAITS. By Michael Lynch and Bruce Walsh. Sunderland, MA: Sinauer Associates. 1998. 980 pp. ISBN 0-87893-481-2. \$64.95 (cloth).

This book represents the first part of a major compendium of quantitative genetics planned by the authors. The book is divided into three sections. The first section covers the basic foundations of quantitative genetic theory, starting with the basic goals of quantitative genetics and then recounting the theoretical underpinnings of the field. These chapters cover much familiar ground. In addition to the standard material defining the average effects of an allele and the genetic covariance among relatives, this section includes clear, elementary treatments of the statistical and mathematical techniques used in quantitative genetics. Because of this feature, the volume really does start from scratch, not assuming prior knowledge of statistics or matrix algebra. The volume is self-contained. The second section of the book is devoted to detection and analysis of quantitative trait loci (QTL). These are individual gene loci with small to moderate effects on phenotypes. There has been a revolution in this field over the past 10 years, and over 200 pages are devoted to it here. These chapters are an excellent introduction to QTL studies, covering concepts and methods used in human genetics, plant and animal genetics, and evolutionary genetics. The third section of the book concerns the procedures used in estimating quantitative genetic parameters such as heritability and genetic correlation between traits. Again, there has been a massive change in these statistical procedures over the past 15 years with the accessibility of high speed computing. The book finishes with 86 pages of appendices on topics like the mathematics of variances and covariances, path analysis, more on matrix algebra and maximum likelihood approaches,

and finally a section on computing the statistical power of quantitative genetic analyses. This last appendix is especially helpful in designing successful experiments.

The authors state that they had two general goals for this work. First, they wanted it to be useful as a textbook of quantitative genetics and so have begun with the development of central concepts from first principles. Second, they wanted to produce a resource book that is useful as a basic reference in quantitative genetics. I'll describe the book and its success in fulfilling these potentially contradictory goals.

When we consider this volume as a textbook, it must be compared to the long-lived standard, *Introduction to Quantitative Genetics* by D. S. Falconer, with recent additional contributions from Trudy Mackay. This book is truly a classic and is still in wide use today, 40 years after its first publication. It is well written and an excellent introduction to the topic. I have used it in classes with undergraduates, including anthropology, biology, music, and journalism majors, and the students uniformly find it very helpful. However, it has become outdated. It hasn't undergone a major overhaul since the 1960 edition, and much has happened over the years, although a chapter on quantitative trait loci was added to the end of the last edition. In reading through the Lynch and Walsh book, I considered its potential as a textbook in comparison to Falconer and Mackay (1996). It is very well written and starts from first principles, as the authors planned. In fact, the volume begins even before the first principles by explaining relevant statistical concepts, such as variance, covariance, and correlation, and the basic operations of matrix algebra. The style followed is lecture-like, as if the authors were speaking directly to you. In contrast to some other mathematically or statistically based texts, I found it relatively easy to follow and very logically organized. In this sense, it could make an excellent choice as a textbook. However, the authors are also extremely successful in

their second goal, and this may compromise the first.

This book is complete. No matter how hard I tried, I could not come up with topics that were left uncovered. As a final test of completeness, I attempted to look up an ingenious and powerful procedure for mapping genes affecting dairy-related traits in cattle, the famous granddaughter design. The topic was easily located in the topical, author, and organism indices. The description is clear and concise. While you wouldn't want to use this source alone to plan such a design, the description given here leads to a reasonable understanding of it. While most anthropologists may not be very interested in this particular design, it is included as an example to show how complete the volume is. It seems as if anything one needs to know (about quantitative genetics) can be found here. The book is incredibly up to date, with many references to work published as late as 1996. As the authors state in the preface, this volume was 10 years in the making, which is probably responsible for its completeness.

However, it is possible that by being complete the authors have made it more difficult to use as a text. While the elementary information is very clearly presented, the book continues on and describes quantitative genetic concepts and models in depth. This may prove daunting to a beginner. As a first step in using this book as a textbook for undergraduates, or even graduate students without substantial population genetics background, it would be necessary to pick out the particular sections of chapters that the students should concentrate on. A typical quantitative genetics course will cover the subjects in volumes 1 and 2 in a single semester, and there is far too much material here to cover in such a restricted time. The breadth and depth of subjects covered in this volume may seem to be intimidating to the nonquantitative geneticist. Since it is, after all, a quantitative genetics book, there are a lot of mathematical concepts covered and a plethora of equations. However, the book is accessible because it is well written and sufficient figures are included so that the relationships displayed by equations can be better understood. Even if the reader does

not want to read or understand the equations in detail, common sense explanations of the concepts are provided.

I strongly recommend this book as a source that anyone interested in genetics and/or evolution should possess. It is a very complete and accessible source book on an important subject. With the recent massive growth in genomic analyses, the concepts described here will play a critical role in human genetics, especially the genetics of complex traits, including common diseases. I have already referred to the book many times in writing my own papers, in reviewing papers, and in understanding what others have written. Its use as a beginning textbook is more problematical and would require strong guidance from the teacher in stressing the parts to be covered. Falconer and Mackay (1996) probably retain their place as a beginning textbook. The relationship between these quantitative genetics books reminds me of our situation in recommending anatomy textbooks to the students. The British edition of *Gray's Anatomy* has no peer in that it is accurate and complete. It should have a place in every biological anthropologist's library as a basic reference. However, we tend not to use it directly as a text in semester courses because, in the limited time we have to teach anatomy concepts, too much material is presented. Likewise, Lynch and Walsh's volume has no peer and is accurate, complete, and accessible. With occasional revisions, it will be a classic for decades. However, it could overwhelm the casual student.

Finally, I am anxious to see Walsh and Lynch's second volume, *Evolution and Selection of Quantitative Traits*. You don't even really have to wait for publication. Early versions of several chapters can be found and downloaded from Bruce Walsh's web site (URL <http://nitro.biosci.arizona.edu>).

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#### LITERATURE CITED

- Falconer DS, Mackay TFC. 1996. Introduction to quantitative genetics, 4th ed. Essex, England: Longman.